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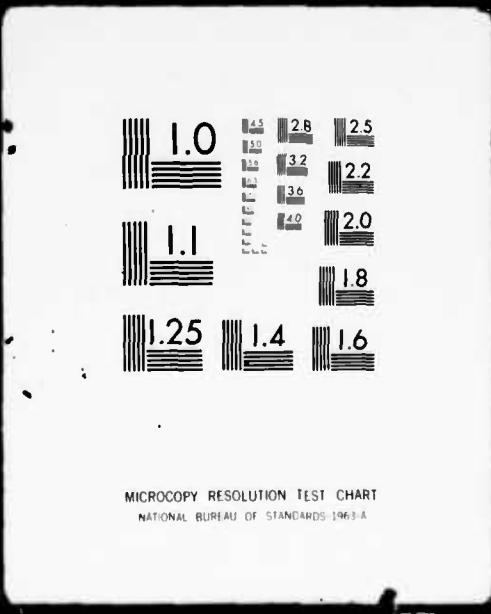
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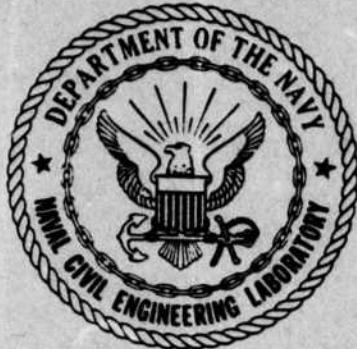
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NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California

Sponsored by
NAVAL FACILITIES ENGINEERING COMMAND

ASSESSMENT OF ALTERNATIVES FOR UPGRADING NAVY
SOLID WASTE DISPOSAL SITES - VOLUME 1

August 1981

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An Investigation Conducted by
JRB Associates, Inc.
McLean, Virginia

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that represent upgrading techniques, and (3) to identify research priorities concerning the technologies for solid waste disposal. This procurement consist of three volumes. This volume (1) contains the criteria for classification of solid waste disposal facilities and practices. These findings are intended to assist engineering field divisions and public works personnel in characterizing the problems facing their disposal facility or practice.

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EXECUTIVE SUMMARY

ASSESSMENT OF ALTERNATIVES FOR UPGRADING
NAVY SOLID WASTE DISPOSAL SITES

TABLE OF CONTENTS

1.0 INTRODUCTION	1-1
2.0 SUMMARY	2-1
2.1 Active Navy Disposal Sites	2-1
2.1.1 Findings	2-1
2.2 Future Navy Solid Waste Disposal Sites	2-2
2.2.1 Findings	2-3
2.3 Economic Impact of Active Disposal Sites	2-4
3.0 RECOMMENDATIONS AND CONCLUSIONS	3-1

LIST OF TABLES

Table

1-1 Alternative Landfill Technologies and Associated Costs	1-3
2-1 Criteria Compliance Expenditures for Upgrading Active Navy Disposal Sites	2-5

1.0 INTRODUCTION

The Civil Engineering Laboratory (CEL), as part of the NAVFAC Solid Waste R&D Program, performed an assessment of alternatives for upgrading Navy solid waste disposal sites. The purpose of this effort was three fold: (1) to determine the extent the Navy may have to modify its current solid waste disposal practices to enable compliance with Section 4004 of the Resource Conservation and Recovery Act; (2) to define technological concepts that represent effective upgrading techniques; and (3) to identify research priorities concerning the technologies for solid waste disposal that are aligned with the Navy's need to maintain its land disposal capability while minimizing cost and manpower requirements. The results of this effort will assist Engineering Field Division (EFD) and Public Works (PW) personnel in characterizing the problems facing their facilities with regards to continued on-base disposal operations, identifying areas of concern in the development of new facilities in wetland and non-wetland areas, and to provide information on the methods and cost of upgrading and/or developing new and existing sites to comply with new regulations.

This effort, under the guidance of CEL, was performed by JRB Associates and EMCN Associates. The work was divided into three major tasks. The first task was the identification and definition of potential environmental and operational problems in land disposal of solid waste aboard Navy installations that relate to the implementation of the Federal landfill classification criteria (40 CFR 257). The work involved the compilation of existing information on Navy disposal sites as well as 15 field visits to gather specific, missing data. The second task was to identify and assess Navy application of technological alternatives for resolving the potential problem areas. This effort involved a review of remedial technological alternatives and associated costs for upgrading disposal sites in accordance with the Federal criteria. The third task was to evaluate the siting and operational procedures required for the development of future Navy solid waste disposal sites. This was accomplished by utilizing the information gathered from the 15 field visits to active on-base disposal sites plus an additional three visits to Naval bases situated in wetlands environments (but not necessarily operating landfills). The document prepared from this effort was divided into three volumes.

Volume 1 identified the "Criteria for Classification of Solid Waste Disposal Facilities and Practices," 40 CFR 257. The eight categories addressed in the Federal regulation were: floodplains, endangered species, surface water, groundwater, disease, air, safety and land spreading. In order to assist field personnel in assessing these categories and identifying areas of possible noncompliance, a "decision tree" flow diagram was developed for each category. The decision tree consists of a series of questions that, when answered about a specific site, determine if remedial action is required. The last segment of this volume identifies the siting and operational requirements for constructing new solid waste disposal sites in wetlands and other environmentally sensitive locations.

Volume 2 of this document is intended to provide guidance to landfill designers and operators in selecting the most cost effective remedial technology based on an assessment of site specific conditions identified using the decision tree guide provided in Volume 1. This volume presents available remedial technologies, as well as avante-garde concepts that may be utilized in bringing Navy solid waste disposal sites into compliance with Federal criteria. A summation of these technologies and their associated costs are presented in Table 1-1.

Volume 3 of this document summarizes the observations and findings of the study, identifies the potential areas of criteria noncompliance within the Navy, and presents an estimate of the economic impact of upgrading the 39 known Navy disposal sites. The results of this effort are summarized in Chapter 2.

CRITERION	REMEDIAL ACTION ALTERNATIVES	UNIT CAPITAL COST*	AVERAGE O&M COSTS (% of Capital Cost)
Floodplains	Perimeter Berms	\$230 - 350/yd	3
	Floodwalls	350 - 600/yd	4
	Control of Backwater Flow	7K - 30K total	9
Endangered Species	Protecting Endangered Species	Site Specific	Site Specific
	Selective Landfilling	Site Specific	Site Specific
	Mitigation Land	Site Specific	Site Specific
Surface Water	Ditches, Diversions, Waterways	15 - 20/yd	6
	Terraces and Benches	5 - 9/yd	5
	Chutes and Downdrains	90/yd	5
	Drainage System	40 - 630/yd	4
	Grading and Revegetation	3 - 8/yd ²	3
	Surface Capping	10 - 30/yd ²	5
	Sedimentation Ponds	8K - 11K/acre ft	4
	Liners	27K - 70K/acre	5

* cost without engineering or contingency costs.
 K = \$1000

TABLE 1-1 Alternative Landfill Technologies and Associated Costs

CRITERION	REMEDIAL ACTION ALTERNATIVES	UNIT CAPITAL COST*	AVERAGE O&M COSTS (% of Capital Cost)
Groundwater	Trenches Grouting Subsurface Drains Extraction Wells Leachate Collection Leachate Treatment Leachate Attenuation Groundwater Monitoring	\$300 - 5K/yd 6K - 11K/yd 530 - 700/yd 25 - 50/vert. ft 25 - 30/yd 20K - 500K total 230 - 325/yd 75/vert. yd +3K/well	2 2 6 4 15 6 \$400/sample + 1%/well
Disease	Septage Sludge - Septic Tank Pumping Controlling Vectors Controlling Rodents Controlling Mosquitos Controlling Health Hazards	Site Specific Site Specific Site Specific Site Specific Site Specific Site Specific	Site Specific Site Specific Site Specific Site Specific Site Specific Site Specific
Air	Controlling Fires Controlling Dust	Site Specific Site Specific	Site Specific Site Specific
Safety	Gases - Well Probes Vents Fires Birds Access	4.2K - 4.7K/acre 400 - 600 Site Specific 32K/acre 30/yd + 2.5K	\$700/sample + 1%/well 9 Site Specific 4 4

Table 1-1 cont'd.

2.0 SUMMARY

2.1 Active Navy Disposal Sites

This section presents the findings of the study based upon the 15 active on-base landfills visited. Selection of these facilities was based upon the following criteria:

- selected disposal sites must be representative of all Navy sites
- geographical areas (North, South and Central regions of the United States) must be represented
- some sites should be located within the Standard Metropolitan Statistical Area where the Navy has been designated lead agency
- operating life of the site should be greater than 3 years

From the possible active on-base landfills, CEL selected the following facilities:

Naval Base, Great Lakes, IL
Naval Weapons Support Center, Crane, IN
Marine Corps Air Station, Quantico, VA
Naval Ordnance Station, Indian Head, MD
NAS Patuxent River, MD
Marine Corps Base, Camp LeJeune, NC
NAS, Whiting Field, FL
NAS, Mayport, FL
NAS, Ocean, Virginia Beach, VA
NAS, Moffett Field, CA
Mare Island, Naval Shipyard, Vallejo, CA
Marine Corps Base, Camp Pendleton, CA
NAS, Miramar, San Diego, CA
NAS, Fallon, NV
NAS, Oak Harbor, WA

2.1.1. Findings

The general observations and findings from the sites visited are as follows:

- Most Navy disposal sites were in good condition and would require only a minor amount of upgrading to comply with RCRA Section 4004.
- A number of the sites were receiving wastes which are on EPA's hazardous waste list; most notably asbestos. Although the Navy has a need to dispose of large quantities of asbestos, this waste material needs to be either taken off site by a certified disposal operator or the Navy needs to apply for individual State permits for disposal of this waste. This has been done on at least one base, and therefore, may be the preferred course of action.
- Most of the disposal operations are small, averaging less than 50 tons per day of solid waste.
- A few sites had waste quantities in excess of 100 TPD, composed mostly of paper and putrescibles. These sites would be likely candidates for alternate disposal technology when costs for upgrading current landfill sites and developing new landfill sites to comply with the criteria are considered.
- The majority (11) of the sites may have a potential problem meeting the groundwater criteria. This is especially true in areas with medium to high soil permeability and high water table, such as the East coast. Groundwater compliance may prove to be the most serious problem facing these landfills. Monitoring programs would be most useful in accessing any adverse impacts these sites may have on the underlying aquifers.
- A potential problem area common to a number of Naval landfills is compliance with the safety criteria, especially site access and gas generation. Remedial actions would require enclosure of the facilities and establishment of gas monitoring programs, respectively.

2.2 Future Navy Solid Waste Disposal Sites

This section summarizes the findings relative to the Federal requirements concerning the siting of new solid waste disposal facilities at Naval installations. This task required visits to three additional Naval bases situated in a wetlands environment.

The bases selected were:

- Naval Amphibious Base, Little Creek, Norfolk, VA
- Naval Shipyard, Norfolk, VA
- Naval Air Station, New Orleans, LA

2.2.1 Findings

Non-Wetland Areas. Based on the information obtained from the 15 active on-base disposal sites and a review of the Federal criteria it was found that the Navy will generally have to do the following to locate a landfill in a non-wetland area:

- groundwater monitoring
- obtain NPDES and Dredge and Fill Permits (as required)
- install leachate collection and treatment systems
- ensure the isolation of the refuse from groundwater

Construction of a new landfill in a non-wetland area will increase disposal costs by approximately 50% to an estimated \$12.00 per ton for disposal.

Wetland Area. From the information gathered at the 3 Naval bases located in a wetlands environment, the following items for constructing a landfill will have to be considered:

- depression of the watertable
- detailed groundwater monitoring
- levees
- leachate treatment and collection
- hydrologic diversion systems
- NPDES and Dredge and Fill Permits

The fact that many Naval installations are located in areas of the U.S. that are typified by wetlands topography presents the Navy with the unique and more difficult problem of disposing of solid waste in an environmentally suitable area. In order to comply with both the Executive and DOD orders on wetland protection, the Navy must evaluate all potential alternatives for solid waste disposal from both the economic and environmental perspectives. Should a Naval activity decide to pursue land-disposal in a wetlands it must be prepared to face a long, difficult, and expensive permitting process and possible legal action. Upon completion of this phase of the development process, the Naval activity must be prepared for the considerable expense of engineering and constructing the actual site. The technologies commonly associated with abating the environmental problems posed by construction of a landfill in a wetland are expensive to design and implement. A conservative estimate for disposal of solid waste in a "wetlands landfill" is \$30.00 per ton.

2.3 Economic Impact of Active Disposal Sites

The remedial alternatives and associated costs identified by the 15 field visits permitted CEL to estimate an overall economic assessment for all 39 disposal sites. This was accomplished by categorizing the remaining 24 disposal sites according to geographical location, and thus identify

certain physical and environmental characteristics. Those nonsurveyed sites situated in the same geographic regions as the surveyed sites were assumed to have similiar problems in meeting the Federal criteria. Table 2-1 shows the economic results of this analysis. The estimated capital costs for constructing the recommended remedial alternatives is approximately \$4.7 million, with annual operation and maintenance (O&M) of \$330,000.

<u>CRITERIA</u>	Expenditures For Upgrading 39 Disposal Sites	
	Total Capital Costs *	Total O&M Costs *
Floodplains	600K	14K
Endangered Species	-	-
Surface Water	1905K	60K
Groundwater	546K	185K
Disease	-	-
Air	-	-
Safety		
Gas	25K	35K
Fire	-	-
Bird Hazard	-	-
Access	663K	36K
total construction	3739K	
9% engineering	<u>337K</u>	
	4076K	
15% contingency	<u>611K</u>	
	4687K	330K
TOTAL: Capital Costs	4687K	
O & M Costs	330K	

* Costs are based on 1979 figures.

(-) No expenditures required.

K \$1000

Table 2-1 Criteria Compliance Expenditures for Upgrading
Active Navy Disposal Sites

3.0 RECOMMENDATIONS AND CONCLUSIONS

3.1 Active Disposal Sites

The RCRA and subsequent 40 CFR 257 criteria requires the disposal of solid waste to be in a manner that minimizes the possibility of adverse effects on health or the environment. From the information provided by the contractor it appears that the 39 active disposal sites owned by the Navy will require minor upgrading (in most cases) to comply with these regulations. The most serious problem facing these landfills will be compliance with the groundwater criteria. It is recommended that monitoring wells and periodic water sampling procedures be established at each disposal site to assess any potential adverse effects.

3.2 Future Disposal Sites

The fact that many Navy installations are located in areas of the U.S. that are typified by wetlands topography presents the Navy with the unique and more difficult problem of disposing of solid waste in an environmentally suitable area. Should the Navy decide to pursue land disposal in a wetlands it must be prepared to face a long, difficult, and expensive permitting process and possible legal action. At this time it is not recommended that wetland environments be considered potential alternatives for disposal of solid waste. Also, the construction of a new landfill in a non-wetland area should be given serious consideration when future disposal alternatives are being evaluated.

VOLUME 1
TABLE OF CONTENTS

PREFACE	vi
1.0 INTRODUCTION	1-1
2.0 RCRA SECTION 4004 CRITERIA	2-1
2.1 The Criteria	2-1
2.1.1 Floodplains	2-2
2.1.2 Endangered Species	2-3
2.1.3 Surface Water	2-3
2.1.4 Groundwater	2-4
2.1.5 Disease	2-6
2.1.6 Air	2-7
2.1.7 Safety	2-8
2.1 Current EPA Interpretation of the Criteria	2-9
2.2.1 Floodplains	2-9
2.2.2 Endangered Species	2-9
2.2.3 Surface Water	2-9
2.2.4 Groundwater	2-10
2.2.5 Safety	2-11
2.2.6 Closure	2-11
2.2.7 Special Wastes	2-11
3.0 CRITERIA DECISION TREE	3-1
3.1 Decision Tree	3-1
3.1.1 Hypothetical Disposal Site Example	3-1
3.1.2 Hypothetical Disposal Site Criteria Compliance	3-3
4.0 REQUIREMENTS FOR CONSTRUCTION OF NEW SOLID WASTE DISPOSAL SITES	4-1
4.1 General Site Development	4-1
4.1.1 General Requirements	4-2
4.1.2 Floodplains	4-3
4.1.3 Endangered Species	4-4
4.1.4 Surface Water	4-4
4.1.5 Groundwater	4-5
4.1.6 Disease	4-7
4.1.7 Air	4-7
4.1.8 Safety - Explosive Gases	4-7
4.1.9 Safety - Fires	4-7
4.1.10 Safety - Bird Hazard	4-7
4.1.11 Safety - Access	4-8

4.2 Wetland Sites	4-8
4.2.1 General Requirements	4-13
4.2.2 Criteria Requirements	4-17
5.0 SUMMARY	5-1
5.1 Active Disposal Sites	5-1
5.2 Siting of New Solid Waste Disposal Facilities	5-1

VOLUME 1
LIST OF ILLUSTRATIONS

Figure

3-1 Hypothetical Disposal Site	3-1
3-2 Floodplains	3-6
3-3 Endangered Species	3-7
3-4 Surface Water	3-8
3-5 Groundwater	3-9
3-6 Disease - Vectors	3-10
3-7 Disease - Sewage Sludge and Septic Tank Pumpings	3-11
3-8 Air	3-12
3-9 Safety - Explosive Gases	3-13
3-10 Safety - Fires	3-14
3-11 Safety - Bird Hazard	3-15
3-12 Safety - Access	3-16

PREFACE

The Civil Engineering Laboratory (CEL), as part of the NAVFAC Solid Waste R&D Program, performed an assessment of alternatives for upgrading Navy solid waste disposal sites. The purpose of this effort was three fold: (1) to determine the extent the Navy may have to modify its current solid waste disposal practices to enable compliance with Section 4004 of the Resource Conservation and Recovery Act; (2) to define technological concepts that represent effective upgrading techniques; and (3) to identify research priorities concerning the technologies for solid waste disposal that are aligned with the Navy's need to maintain its land disposal capability while minimizing cost and manpower requirements. The results of this effort will assist Engineering Field Division (EFD) and Public Works (PW) personnel in characterizing the problems facing their facilities with regards to continued on-base disposal operations, identifying areas of concern in the development of new facilities in wetland and non-wetland areas, and to provide information on the methods and cost of upgrading and/or developing new and existing sites to comply with new regulations.

This effort, under the guidance of CEL, was performed by JRB Associates and EMCN Associates. The work was divided into three major tasks. The first task was the identification and definition of potential environmental and operational problems in land disposal of solid waste aboard Navy installations that relate to the implementation of the Federal landfill classification criteria (40 CFR 257). The work involved the compilation of existing information on Navy disposal sites as well as 15 field visits to gather specific, missing data. The second task was to identify and assess Navy application of technological alternatives for resolving the potential problem areas. This effort involved a review of remedial technological alternatives and associated costs for upgrading disposal sites in accordance with the Federal criteria. The third task was to evaluate the siting and operational procedures required for the development of future Navy solid waste disposal sites. This was accomplished by utilizing the information gathered from the 15 field visits for the active on-base disposal sites and an additional three visits to Naval bases situated in a wetlands environment (but not necessarily operating a landfill).

This document is comprised of three volumes. Volume 1 contains the "Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257)," a "Decision Tree" to determine areas of non-compliance for active disposal sites, and the operational procedures necessary for developing future Navy solid waste disposal sites.

Volume 2 provides technological alternatives for upgrading disposal sites to comply with the criteria, and the associated costs for implementation of these technologies.

Volume 3 presents the general observations and findings of the study, and the projected impact of the Federal regulations on the Navy.

1.0 INTRODUCTION

The promulgation of the 40 CFR 257 Criteria established the format for determining which disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment. The eight categories addressed in the Federal regulation are: floodplains, endangered species, surface water, groundwater, disease, air, safety and land spreading. If a disposal site is found to violate one or more of the criteria it will be classified as an "open dump," and published in the Environmental Protection Agency (EPA) inventory. Upon appearing in the inventory the site must be closed or upgraded according to a state-established compliance schedule.

The first volume of this document will serve a three-fold purpose:

- (1) identify and define the criteria and their impact on Navy disposal practices
- (2) provide assistance to field personnel in assessing areas of non-compliance with 40 CFR 257. This is accomplished by use of a "Decision Tree" flow diagram for each of the criteria, which identifies the information that is required for determining compliance.
- (3) identify the siting and operational requirements for constructing new solid waste disposal sites in wetlands and other environmentally sensitive locations.

2.0 RCRA SECTION 4004 CRITERIA

Section 4004 of the Resource Conservation and Recovery Act, "Criteria for Classification of Solid Waste Disposal Facilities and Practices", was promulgated in final form in the Federal Register of September 21, 1979. The Criteria were developed to facilitate State Solid Waste Management planning under Subtitle D of RCRA by providing minimum standards for determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on human health or the environment. The Criteria do not pre-empt state regulations concerning the disposal of solid waste as long as those regulations are as stringent as, or more stringent than, the standards put forth in the Criteria. RCRA allows flexibility among States in evaluating individual sites in light of local conditions as long as minimum standards are met. However, all solid waste disposal facilities, new and existing, are subject to these standards.

In evaluating and planning future solid waste disposal alternatives, the Navy will have to deal with the individual state agencies responsible for implementing the Criteria. It is important to note that the individual states, through the responsible state agency named in the State Solid Waste Management Plan, will be responsible for the interpretation and implementation of RCRA once that management plan has been approved. Therefore, while the Federal Government has set the minimum standards which should be met for a disposal site to continue operation, individual site operators should be sensitive to their state's interpretation of the Criteria and any resultant alteration of the standards.

2.1 THE CRITERIA

In this section, the individual criteria for evaluating adverse health and environmental affects are discussed. Criterion 257.3-5 "Application to Land Used for the Production of Food Chain Crops" is not included in this discussion as it is unlikely that it would apply to any Navy facility.

2.1.1 Floodplains

257.3-1 Floodplains.

(a) Facilities or practices in floodplains shall not restrict the flow of the base flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.

(b) As used in this section:

(1) "Base flood" means a flood that has a 1 percent or greater chance of recurring in any year or a flood of a magnitude equalled or exceeded once in 100 years on the average over a significantly long period.

(2) "Floodplain" means the lowland and relatively flat areas adjoining inland and coastal waters, including flood prone areas of offshore islands, which are inundated by the base flood.

(3) "Washout" means the carrying away of solid waste by waters of the base flood.

The major concern lies in the possibility that a facility, by reducing or blocking the area normally available in the floodplain for inundation, may increase the flooding at other areas along the stream, increasing flood hazard and damage. Additionally, while the landfill may be inundated (particularly if this reduces increased flooding up and down stream), waste from the fill must be restricted from washing out of the fill to downstream areas.

2.1.2 Endangered Species

257.3-2 Endangered Species.

(a) Facilities or practices shall not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife

(b) The facility or practice shall not result in the destruction or adverse modification of the critical habitat of endangered or threatened species as identified in 50 CFR Part 17.

The criterion defines taking as meaning harassing, harming, pursuing, hunting, wounding, killing, trapping, capturing, or collecting.

2.1.3 Surface Water

257.3-3 Surface Water

(a) A facility or practice shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under Section 402 of the Clean Water Act, as amended.

(b) A facility or practice shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under Section 404 of the Clean Water Act, as amended.

(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended.

(d) Definitions of the terms "Discharge of Dredged Material", "Point Source", "Pollutant", "Waters of the United States", and "Wetlands" can be found in the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., and implementing regulations, specifically 33 CFR Part 323 (42FR 37122, July 19, 1977).

For the purposes of RCRA, wetlands are considered to be part of the surface waters of the United States and therefore the siting of solid waste disposal facilities in wetlands is strongly discouraged. Point source discharges of leachate or runoff collected or channelled by man are required to obtain a NPDES permit. Operations where dredge and fill material or solid waste is deposited in wetlands or other surface waters require a 404 Dredge and Fill permit. Non-point sources, unchannelled runoff, or seeps are examples of discharges subject to regulations to be established under the 208 planning program. Planning for the 208 program is carried out by local or regional agencies under State and EPA approval. However, it is understood that such programs, in order to receive the necessary approval of EPA, will be required to regulate non-point discharges, including those from solid waste disposal facilities. The thrust of these regulations will be to prevent or minimize such discharges.

2.1.4 Groundwater

257.3-4 Groundwater

(a) A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or beyond an alternative boundary specified in accordance with paragraph (b) of this section.

(b) Only a State with a solid waste management plan approved by the Administrator pursuant to Section 4007 of the Act may establish an alternative boundary to be used in lieu of the solid waste boundary. A State may specify such a change would not result in contamination of groundwater which may be needed or used for human consumption. This finding shall be based on analysis and consideration of all of the following factors:

(1) The hydrogeological characteristics of the facility and surrounding land;

- (2) The volume and physical and chemical characteristics of the leachate;
- (3) The quantity, quality, and directions of flow of groundwater;
- (4) The proximity and withdrawal rates of groundwater users;
- (5) The availability of alternative drinking water supplies;
- (6) The existing quality of the groundwater including other sources of contamination and their cumulative impacts on the groundwater; and
- (7) Public health, safety, and welfare effects.

The protection of groundwater resources from current and future contamination was of prime concern in formulation of the Criteria. This criterion specifically states that a solid waste disposal facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or an alternative boundary set by the state if the state's Solid Waste Management Plan has been approved by EPA. This is to assure that alternative boundaries are set only in instances where technical, analytical, and public health considerations warrant it.

For the purposes of this criterion, an underground drinking water source is an aquifer which currently supplies water for human consumption or which contains less than 10,000 mg/l total dissolved solids. An aquifer is considered any geologic formation, group of formations, or part thereof, capable of yielding useable quantities of groundwater to springs or wells. Contamination is defined as an increase to the concentration in groundwater of any pollutant listed in the National Interim Primary Drinking Water Regulation (NIPDWR) so that it exceeds the maximum contaminant level (MCL) set forth in that regulation (and modified in Appendix I to the criteria), or to increase the concentration at all should it be above the MCL prior to exposure to leachate from the facility.

In order to determine that no contamination is taking place, groundwater monitoring wells should be placed around the boundary of the solid waste within the facility (or at an alternate boundary set by the state). Wells should not be placed within this boundary because they may act as a conduit for leachate to directly enter the aquifer. To determine the effect of the facility on groundwater quality, wells should be established around the site boundary and periodically monitored to establish groundwater gradients and concentrations of potential pollutants.

2.1.5 Disease

257.3-6 Disease.

(a) Disease Vectors. The facility or practice shall not exist or occur unless the on-site population of disease vectors is minimized through the periodic application of cover material or other techniques as appropriate so as to protect public health.

(b) Sewage sludge and septic tank pumpings (Interim Final). A facility or practice involving disposal of sewage sludge or septic tank pumpings shall not exist or occur unless in compliance with paragraphs (b)(1), (2) or (3) of this section.

(1) Sewage sludge that is applied to the land surface or is incorporated into the soil is treated by a process to significantly reduce pathogens prior to application or incorporation. Public access to the facility is controlled for at least 12 months, and grazing by animals whose products are consumed by humans is prevented for at least one month. Processes to significantly reduce pathogens are listed in Volume 2, Section A. (These provisions do not apply to sewage sludge disposed of by a trenching or burial operation.)

(2) Septic tank pumpings that are applied to the land surface or incorporated into the soil are treated by a process to significantly reduce pathogens (as listed in Volume 2, Section A), prior to application or incorporation, unless public access to the facility is controlled for at least 12 months and unless grazing by animals whose products are consumed by humans is prevented for at least one month. (These provisions do not apply to septic tank pumpings disposed of by a trenching or burial operation.)

(3) Sewage sludge or septic tank pumpings that are applied to the land surface or are incorporated into the soil are treated by a process to further reduce pathogens, prior to application or incorporation, if crops for direct human consumption are grown within 18 months subsequent to application or incorporation. Such treatment is not required if there is no contact between the solid waste and the edible portion of the

crop; however, in this case the solid waste is treated by a process to significantly reduce pathogens, prior to application; public access to the facility is controlled for at least 12 months; and grazing by animals whose products are consumed by humans is prevented for at least one month. If crops for direct human consumption are not grown within 18 months of application or incorporation, the requirements of paragraphs (b) (1) and (2) of this section apply. Processes to further reduce pathogens are listed in Volume 2, Section A.

The disease criterion for facilities not accepting sewage sludge or septic tank pumpings states that the presence of disease vectors should be minimized through the application of cover material (or other appropriate techniques). For sites accepting sewage sludge and/or septic tank pumpings, the material should be treated with a process to significantly reduce pathogens (e.g., aerobic digestion, anaerobic digestion, air-drying, etc.) and public access to the site should be controlled for at least 12 months. For septic tank pumpings only, either of these provisions is sufficient to satisfy the criterion.

2.1.6 Air

257.3-7 Air

(a) The facility or practice shall not engage in open burning of residential, commercial, institutional or industrial solid waste. This requirement does not apply to infrequent burning of agricultural wastes in the field, silvicultural wastes for forest management purposes, land-clearing debris, diseased trees, debris from emergency clean-up operations, and ordnance.

(b) The facility or practice shall not violate applicable requirements developed under a State implementation plan approved or promulgated by the Administrator pursuant to Section 110 of the Clean Air Act.

(c) As used in this section "open burning" means the combustion of solid waste without (1) control of combustion air to maintain adequate temperature for efficient combustion, (2) containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, and (3) control of the emission of the combustion products.

The site shall not practice open burning of residential, commercial, or industrial wastes. Burning in a controlled manner, such as in an incinerator or resource recovery facility where emissions to the air are minimized in conformance with state implementation plans and the Clean Air Act, is allowed.

2.1.7 Safety

257.3-8 Safety

(a) Explosive gases. The concentration of explosive gases generated by the facility or practice shall not exceed:

(1) Twenty-five percent (25%) of the lower explosive limit for the gases in facility structures (excluding gas control or recovery system components); and

(2) The lower explosive limit for the gases at the property boundary.

(a) As used in this section:

(3) "Explosive gas" means methane (CH_4).

(4) "Facility structures" means any buildings and sheds or utility or drainage lines on the facility.

(5) "Lower explosive limit" means the lowest percent by volume of a mixture of explosive gases which will propagate a flame in air at 25°C and atmospheric pressure.

(b) Fires. A facility or practice shall not pose a hazard to the safety of persons or property from fires. This may be accomplished through compliance with 257.3-7 and through the periodic application of cover material or other techniques as appropriate.

(c) Bird hazards to aircraft. A facility or practice disposing of putrescible wastes that may attract birds and which occurs within 10,000 feet (3,048 meters) of any airport runway used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway used by only piston-type aircraft shall not pose a bird hazard to aircraft.

(d) Access. A facility or practice shall not allow uncontrolled public access so as to expose the public to potential health and safety hazards at the disposal site.

2.2 CURRENT EPA INTERPRETATION OF THE CRITERIA

The observations put forth in this section refer to current interpretation and enforcement of the RCRA criteria by EPA. Information for this section has been taken from prior experience in upgrading specific landfills under contract to EPA, and from our experience in preparing the Environmental Impact Statement for the 4004 criteria for EPA's Office of Solid Waste Management.

2.2.1 Floodplains. If the floodplain impact of a Navy facility is confined to Navy property, we foresee minimal enforcement of this criterion. Downstream areas should be protected by preventing washout of waste and efforts should be made to minimize the landfill's impact on ground and surface water quality.

2.2.2 Endangered Species. This criterion places a straight forward standard and is expected to be enforced in such a manner. Critical habitat is considered to be any land, air, or water area (exclusive of man made structures), the loss of which would appreciably decrease the likelihood of recovery or survival of a listed species or a segment of its population.

2.2.3 Surface Water. In regards to the surface water criterion, several points of clarification may be helpful in evaluating its impact on Navy landfills:

- Surface Water - While channeling of water technically meets the criterion's definition of point source pollution, we suspect that regulatory agencies will not require an NPDES permit if channeling is for the purpose of diverting water from a source of contamination, i.e., the landfill, and if diversion is done in a manner that does not greatly alter water quality to the downstream environment or create a siltation problem.

- Wetlands - Filling of low-lying areas, either for reclamation or waste disposal will need a 404 permit. 404 permits for dredge and fill operations are administered by the Corps of Engineers. Development of new landfills in wetlands is sharply discouraged in conformance with Executive Order 11990, Protection of Wetlands.
- Non-Point Source - Strict interpretation of this criterion would make it applicable only where there is an approved 208 (statewide water quality management) plan. However, it is assumed that even in areas without a 208 plan, if there is a visual appearance or demonstrated contamination from a non-point source, that source will need to be controlled.

2.2.4 Groundwater. In interpreting the groundwater criterion, EPA is expected to take a stringent stance. We believe the following points should be included concerning enforcement of this section:

- Monitoring Wells - While monitoring wells are not specifically required in the final criteria, it is implied that they will be required to demonstrate conformance with water quality parameters. In the absence of data from such wells, investigators might conclude that the facility does not comply.
- Maximum Contaminant Levels (MCL) - Current MCL's are taken from the primary drinking water standards of the National Interim Primary Drinking Water Regulation (NIPDWR) set forth under the Safe Drinking Water Act. It is possible that the secondary standards of the National Secondary Drinking Water Regulation may be added to this list. Primary standards concern pollutants adversely affecting public health. Secondary standards would add MCL's for pollutants affecting odor, color, and taste. The addition of the secondary standards would make compliance more difficult, but we do not expect their addition to the criteria in the immediate future. A proposed rule adding these MCL's to the criteria was published for public comment in the Federal Register for September 21, 1979.

In addition, collection of data from monitoring wells may be desirable at several different times of year to assess seasonal fluctuations.

2.2.5 Safety. The safety criteria in general are not directly applicable to conditions at most Navy landfills. The comments below are based on our judgment of how they will be applied to the Navy and what safety precautions the Navy may view as desirable:

- Explosive Gas - Criterion does not anticipate conditions at a Navy installation where facilities are typically located within large expanses of federal land. If the disposal site is not located near the base boundary or near structures, explosive gas criterion may not be enforced. Structures should be defined to include underground utilities as well as buildings on the Naval station but not associated with the landfill.
- Bird Hazard - Criterion does not specifically apply as runways on Navy facilities are not open to public use. The Navy should evaluate bird hazard problems on an individual site basis without regard to distance requirements set in the criterion to insure the safety of its air facilities.
- Access - Criterion does not anticipate strict security of Naval bases and special controls to limit and monitor access by the public. Signing may be a viable means of controlling access to the disposal areas to insure that base contractors do not dispose of hazardous wastes, such as motor oils, in the landfill. In all cases, minor fencing and gating should be adequate to control access during non-operating hours.

2.2.6 Closure. Several of the bases inspected had large landfills with extensive areas completed and final cover applied. For these sites we believe inspectors will consider completed sections to be closed landfills, and therefore, remedial action for these sections will not be required.

2.2.7 Special Wastes. Currently two waste types - phosphorous mine tailings, and uranium milling and mining wastes - are categorized as special wastes, and regarded as hazardous wastes. It is likely that these wastes, possibly with some form of special handling, will be allowed to be disposed of in 4004 landfills complying with the criteria. Fly ash, bottom ash, and drilling mud are no longer considered special or hazardous wastes.

3.0 CRITERIA DECISION TREE

The U.S. Navy operates approximately 40 solid waste disposal facilities. To assist Public Works personnel and site operators not familiar with the complexity of the regulations, a decision tree approach has been developed for each of the RCRA criteria.

3.1 DECISION TREE

The decision tree for assessing compliance with RCRA in terms of the criteria is illustrated in Figures 3-1 through 3-11. The decision tree consists of a series of questions that should be answered about a specific site. To clarify the format for using the decision tree, a hypothetical situation is discussed in detail.

3.1.1 Hypothetical Disposal Site Example

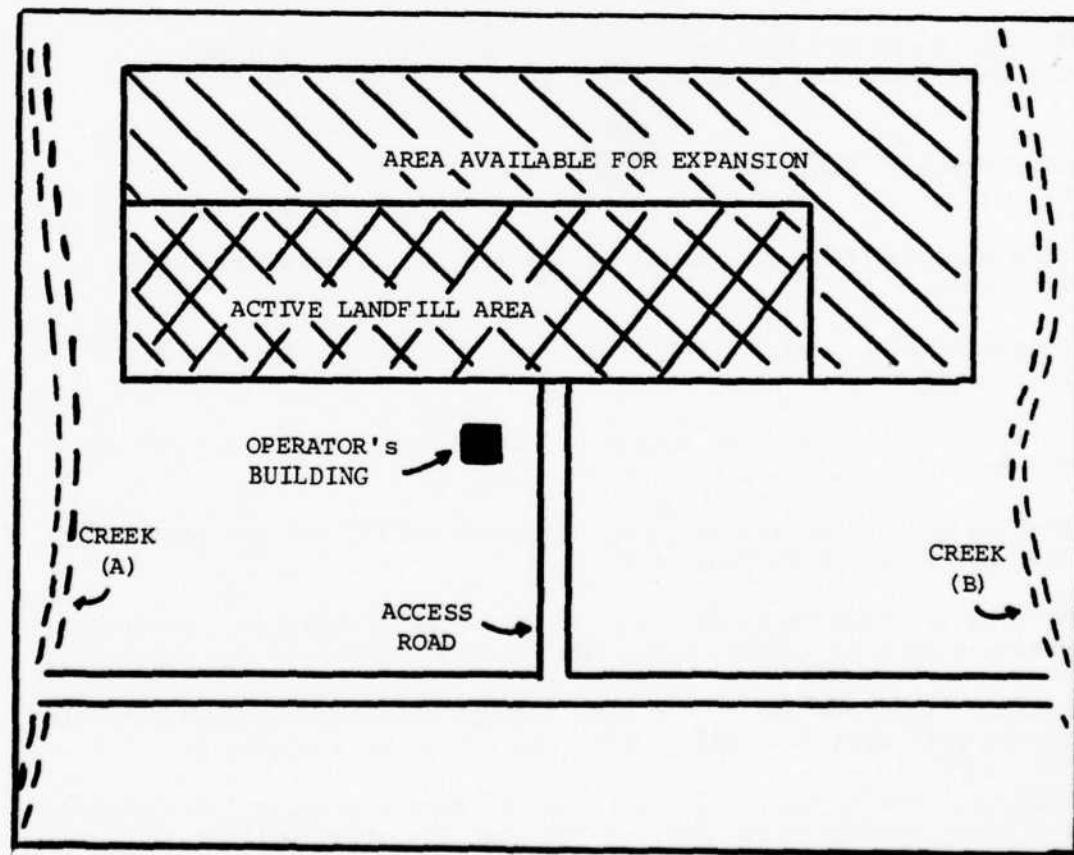


Figure 3-1. Hypothetical disposal site.

SITE LOCATION AND OPERATION

The site currently accepts only putrescible and construction wastes.

Site is operated according to ramp method.

A 6 inch daily cover is applied to wastes, with a 3 foot final cover.

Cover soils used ranged from sand to sandy clay loams, all of which are fairly porous soils.

The landfill is currently elevated 30 feet above grade.

The landfill is not located within 1,000 feet of any building except a shack at the entrance of the fill.

The site is not secured by any physical barriers.

There are no gas vents in the landfill.

Although there are rare and endangered species on the base, none have been identified at the site.

GEOLOGIC/HYDROLOGIC FEATURES

Soils underlaying the landfill site are predominantly sands and clay sands.

The groundwater level is approximately 4 feet below the bottom of the landfill.

The site sits between two creeks and abuts marsh areas associated with each.

Trenches are dug at the periphery of the landfill and are backfilled with sand to mitigate leachate.

There is no flood protection or runoff collection system. However, surface runoff is tested weekly for BOD and coliforms.

Groundwater is sampled once a year through five test wells around the site to determine leachate quality and effect on groundwater.

Wells adjacent to the creeks (A) and (B) showed substantially higher (one order of magnitude) COD and TDS than the other wells.

Annual precipitation in the area is about 50 inches, with approximately 12 inches of evapotranspiration.

From the hypothetical site information the decision tree for each of the criteria can be utilized (see Figures 3-1 to 3-11) in determining disposal site compliance. When a decision is reached which indicates the site is not in compliance with a criteria, remedial technologies are presented. More information on remedial technologies identified and a cost analysis for implementation are presented in Volume Two.

3.1.2 Hypothetical Disposal Site Criteria Compliance

Responses to the decision tree questions for each of the criteria are as follows:

For Figure 3-1, the question is:

- *Is the facility within a 100-year flood plain?*

The answer is no, and, therefore, the site complies with the regulations.

For Figure 3-2, the question is:

- *Are endangered species present at the site?*

The answer is no, therefore, go to the next question.

For Figure 3-3, the question is:

- *Is a surface body of water located on-site or within 1/2 mile of the site?*

The answer to this question is yes, therefore, go to the next question.

- *Does the facility discharge any material in this body of water?*

The answer to this question is yes, proceed to the next question.

- *What type of material is discharged?*

The answer is leachate. The remedial actions include a mandatory NPDES permit, 404 Dredge and Fill Permit and runoff control devices.

For figure 3-4, the question is:

- *Is groundwater used as a drinking water source on base or in nearby areas?*

The answer is yes, continue to the next question.

- *Which best describes the soil type?*

The answer is sandy, continue to next question.

- *What is the annual precipitation?*

The answer is greater than 20 inches. Thus the required remedial action for this site is to perform groundwater monitoring and test for NIPDWR pollutants. The recommended remedial actions are leachate control, leachate containment, leachate collection and leachate treatment.

For figure 3-5, the question is:

- Are rodents, opossums or skunks present at the site?

The answer is no - continue to next question.

- Are large numbers of flies or mosquitos present at the site, or is standing or stagnant water on-site?

The answer is no, and thus the hypothetical site complies for this criterion.

For figure 3-6, the question is:

- Are sewage sludge or septic tank pumpings disposed of in the fill?

The answer is yes - continue to next question.

- Are crops for direct human consumption grown on site?

The answer is no - therefore go to last question.

- Which material is disposed at the site?

The answer is septic tank pumpings. The required remedial actions are to process to reduce pathogens, control public access and animal grazing, and to obtain proper permits for such disposal from state health authorities.

For figure 3-7, the question is:

- Is open burning practiced at the site?

The answer is no, and the hypothetical site complies with this criterion.

For figure 3-8, the question is:

- Does the landfill accept organic wastes?

The answer is yes, proceed to next question.

- What is the soil type?

The answer is sand, proceed to next question.

- *What is the distance to the nearest facility?*

The answer is greater than 1200 feet, and the required remedial action for the hypothetical site is gas monitoring.

For figure 3-9, the question is:

- *Are combustible wastes disposed at the site?*

The answer is yes, thus continue to the next question.

- *Is daily cover (6 inches) applied or water available on site?*

The answer is yes, and thus the site complies with this criterion.

For figure 3-10, the question is:

- *Is the facility within 5,000 feet of any public used airport or 10,000 feet of a public used airport open to turbojet aircraft?*

The answer to this question is no, thus the hypothetical site complies with this criterion.

For figure 3-11, the question is:

- *Is access to the site limited to authorized personnel during operating hours?*

The answer to this question is no, continue to next question.

- *Is the site gated and fenced or regularly patrolled during non-operating hours?*

The answer is no, the required remedial action for this site is controlled access during operating and non-operating hours.

FLOODPLAINS	
<p>In the facility within a 100-year floodplain?</p> <p>Residential Action Required</p> <p>In the facility currently protected against waste washout by the 100-year base flood?</p>	
Yes	Yes - complies
No	No
don't know - a	
<p>Residential Actions</p> <ol style="list-style-type: none"> 1. Perimeter berm, flood walls 2. Landfill slope protection 3. Storage area enlargement 4. Channel improvements 	
<p>Other Activities</p> <ol style="list-style-type: none"> a. Contact District Engineer's Office (Army Corps of Engineers) or local navigable waters control office to determine if facility is or is not in 100-year floodplain, then answer question. 	

Figure 3-2 Floodplains

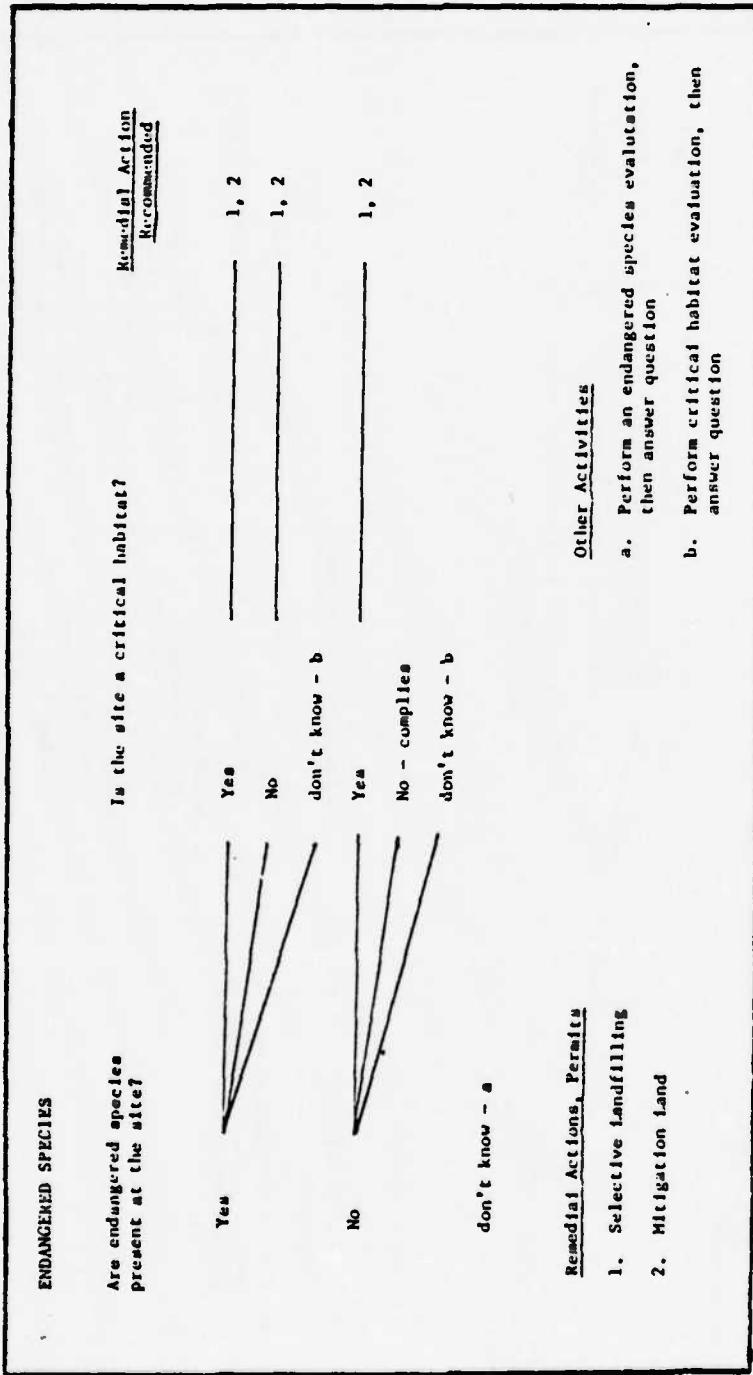


Figure 3-3 Endangered Species

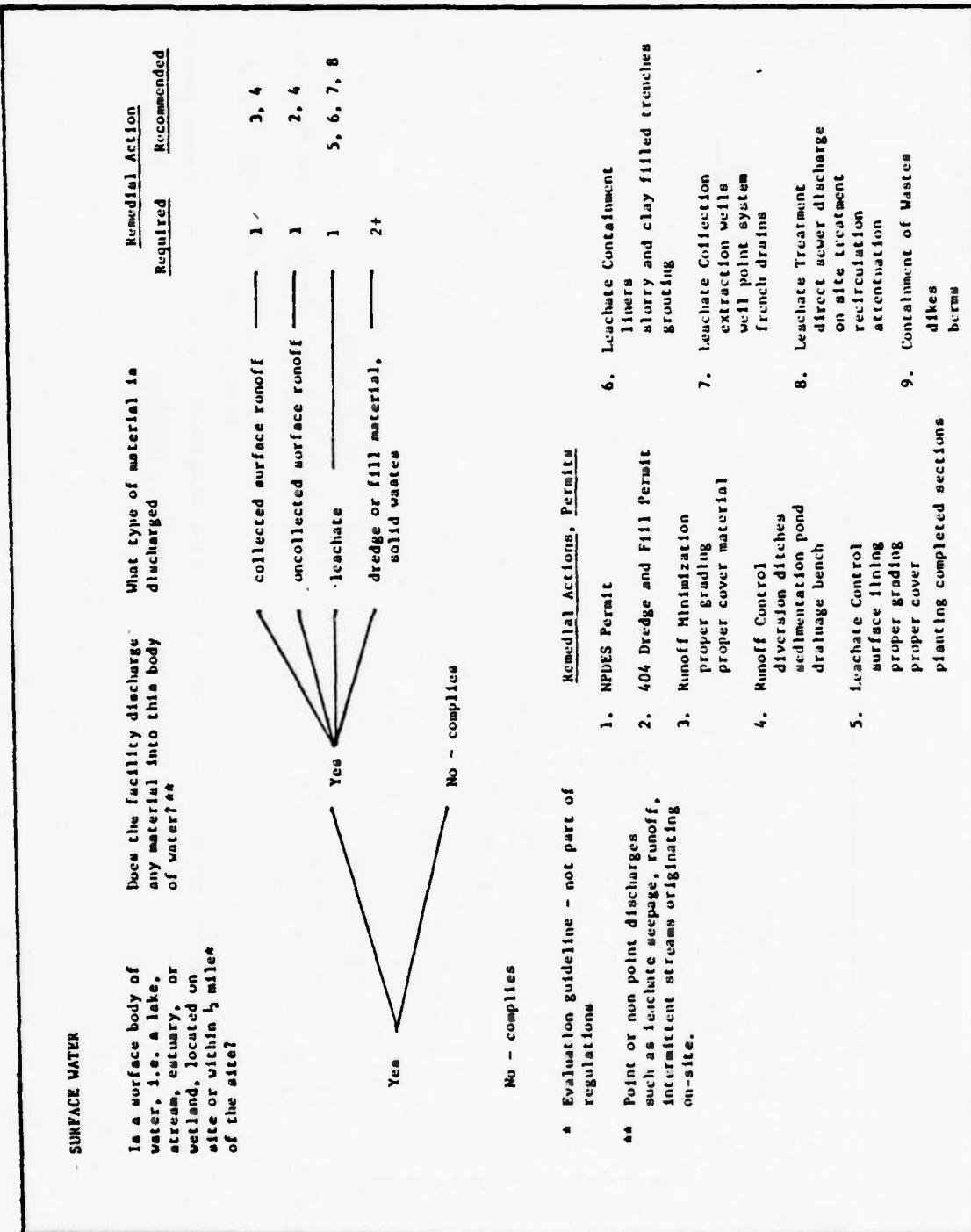


Figure 3-4 Surface Water

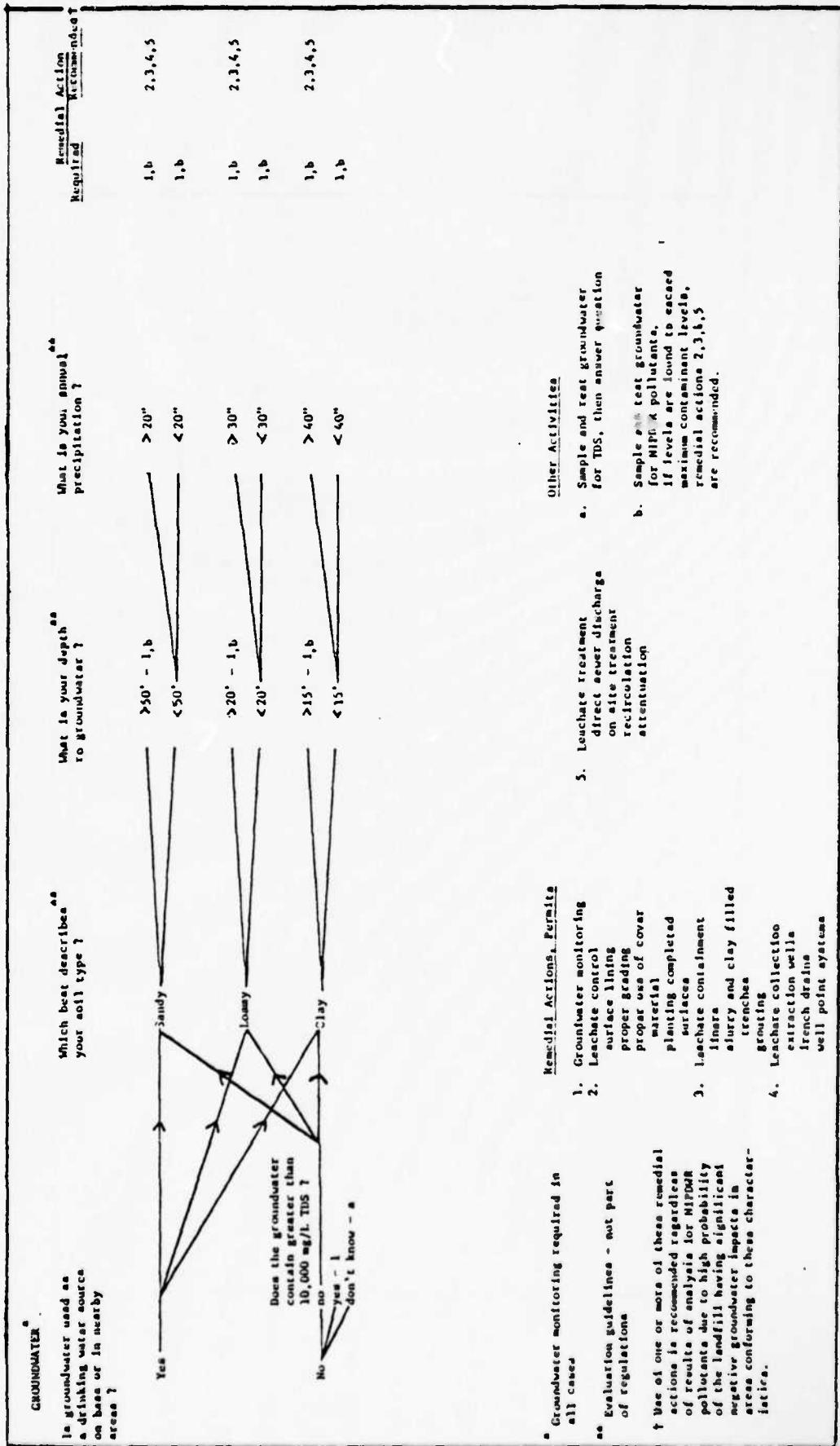
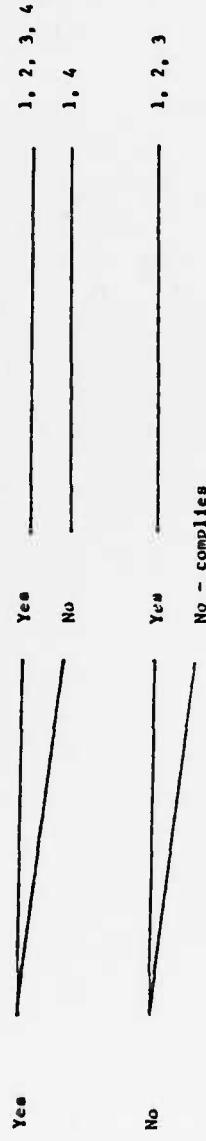


Figure 3-5 Groundwater

DISEASE - VECTORS

Are rodents (mice, rats), opossums, or skunks, present at the site?

Are unusual numbers* of flies or mosquitoes present at the site, or is standing or stagnating water on-site?



* Unusual numbers - greater than numbers normal for similar areas in same geographical region

Remedial Actions

1. Application of 6" (minimum) daily cover
2. Proper drainage of fill surface and operating area
3. Insecticides
4. Rodenticides

Figure 3-6 Disease - Vectors

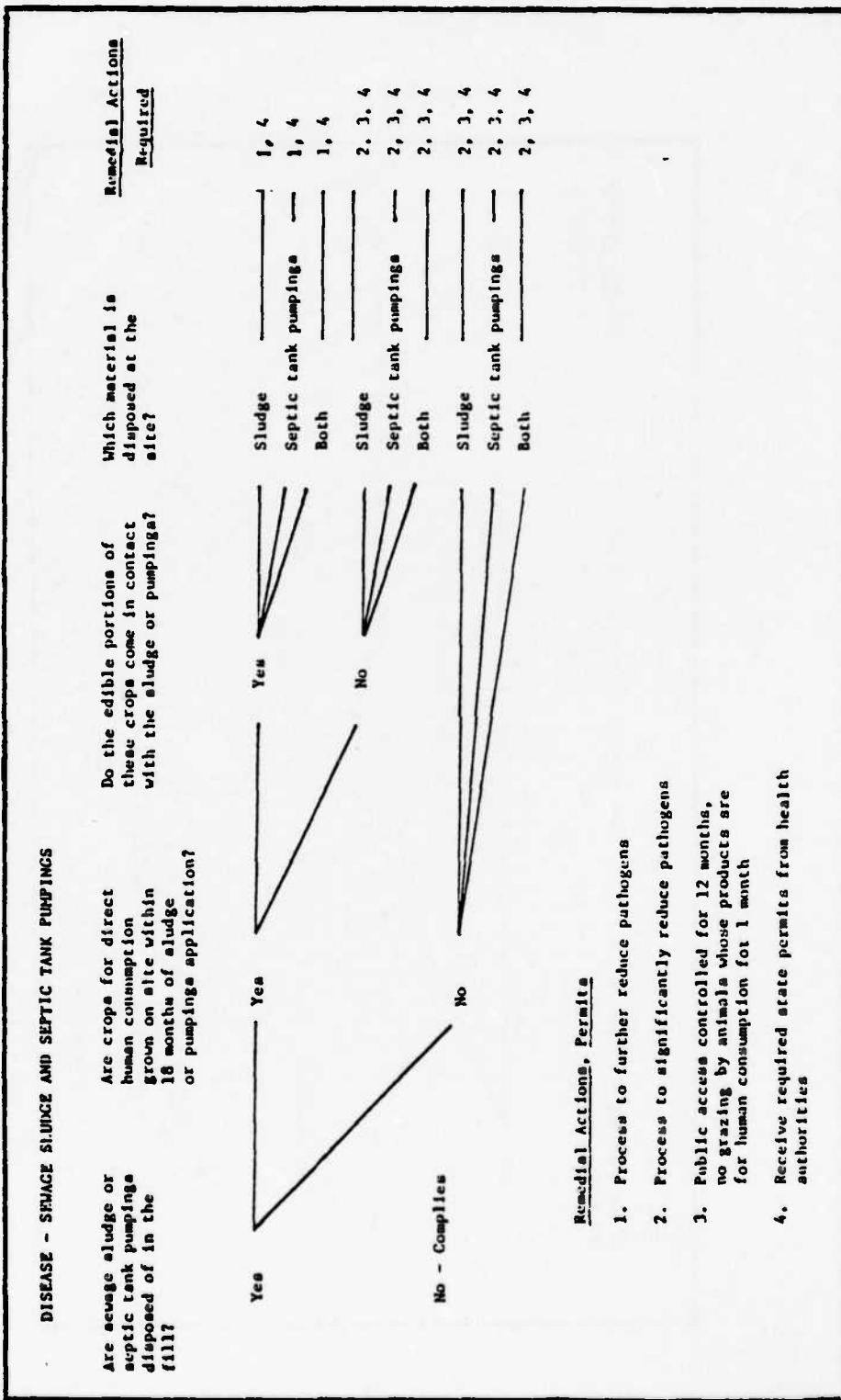


Figure 3-7 Disease - Sewage Sludge and Septic Tank Pumpings

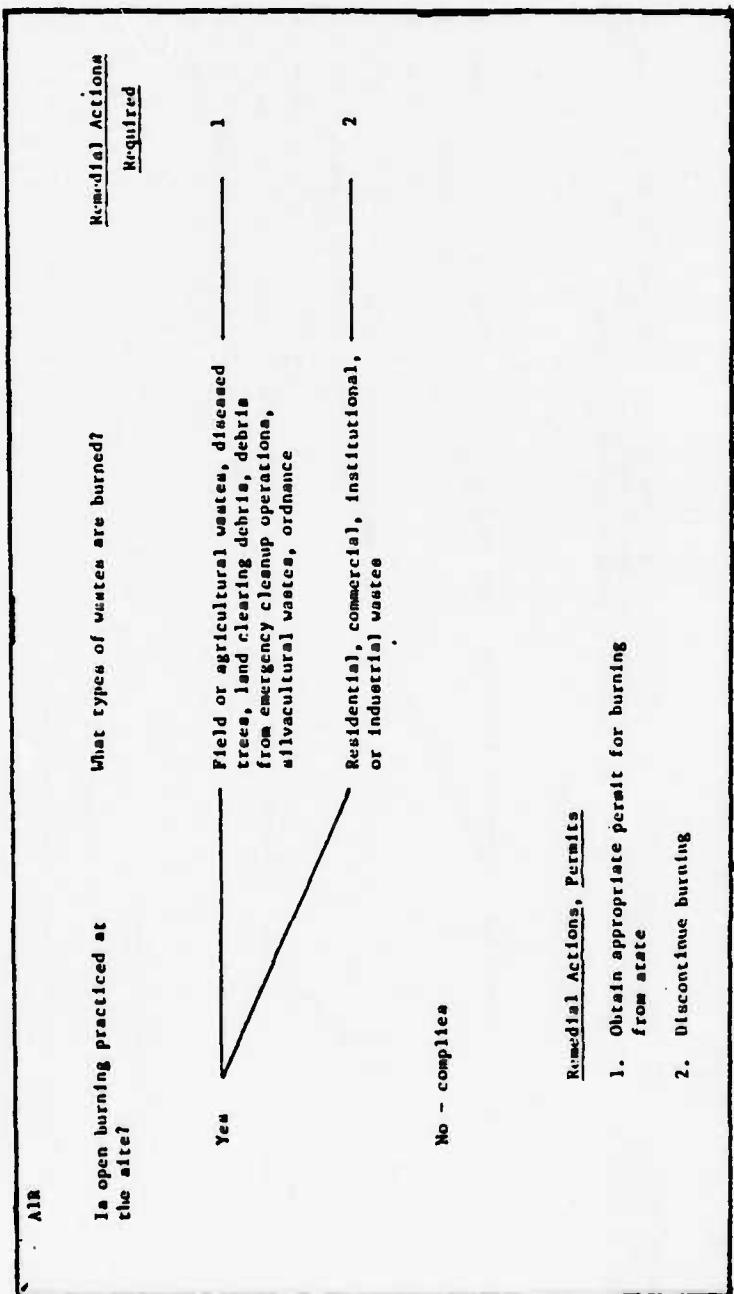


Figure 3-8 Air

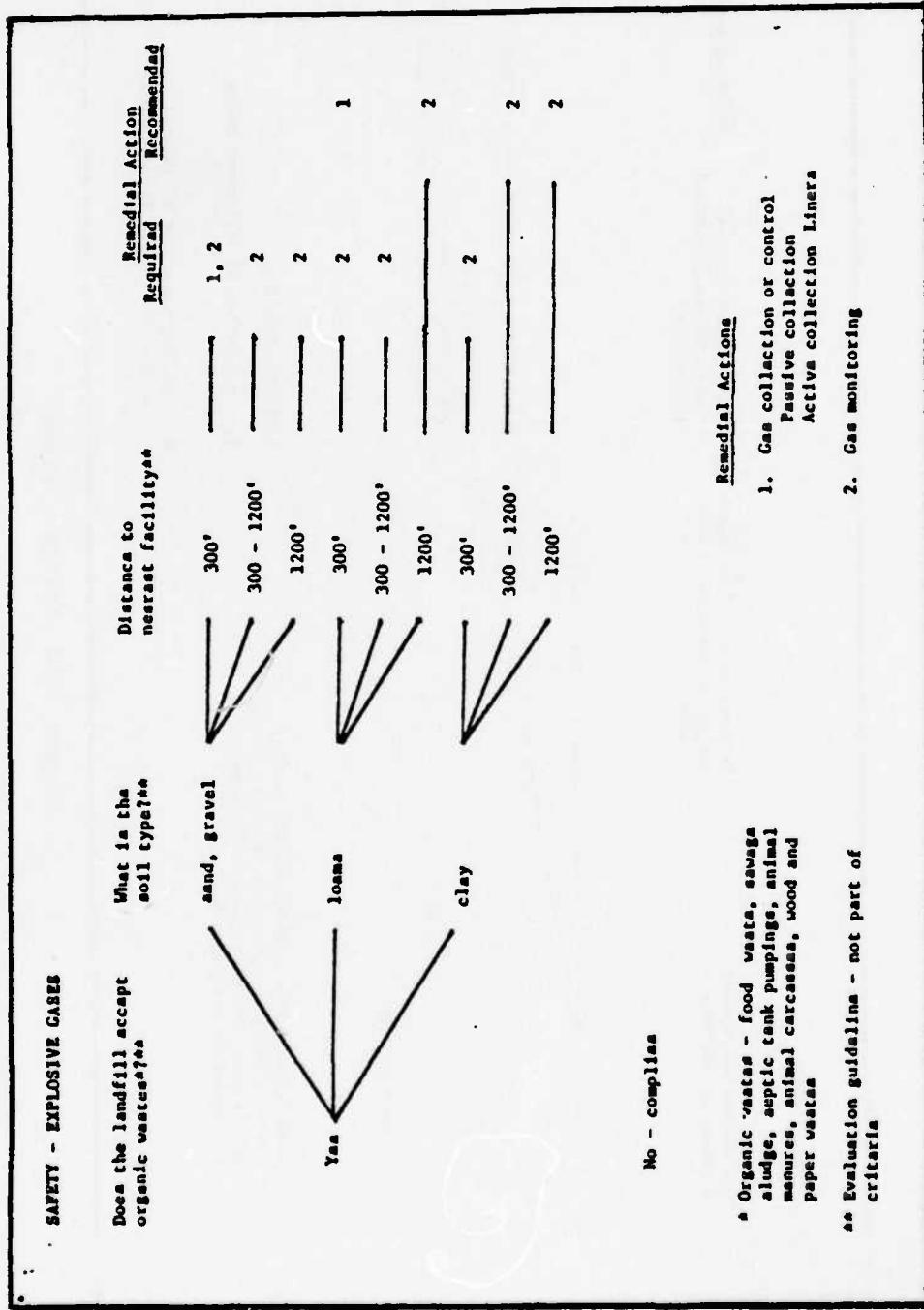


Figure 3-9 Safety - Explosive Gases

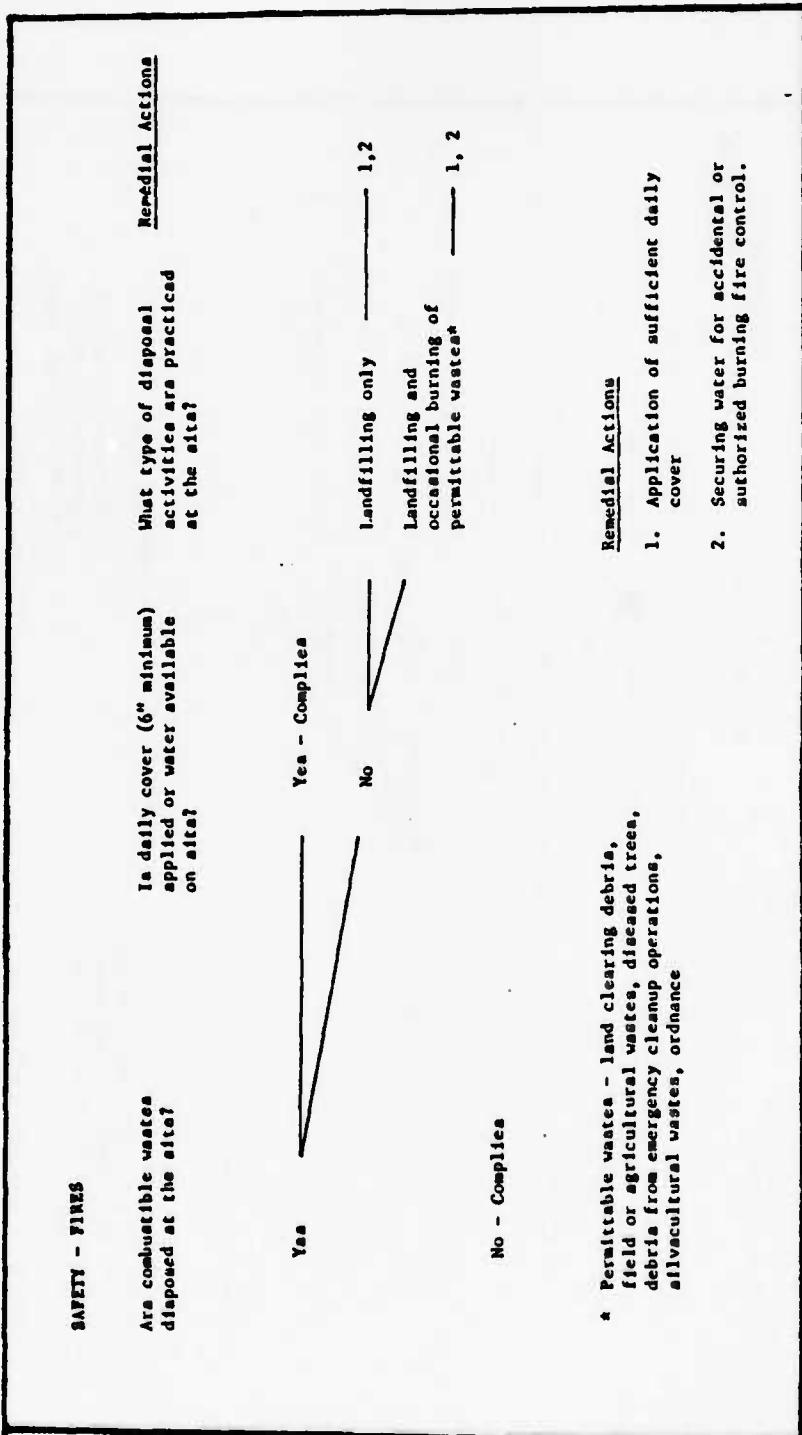


Figure 3-10 Safety - Fires

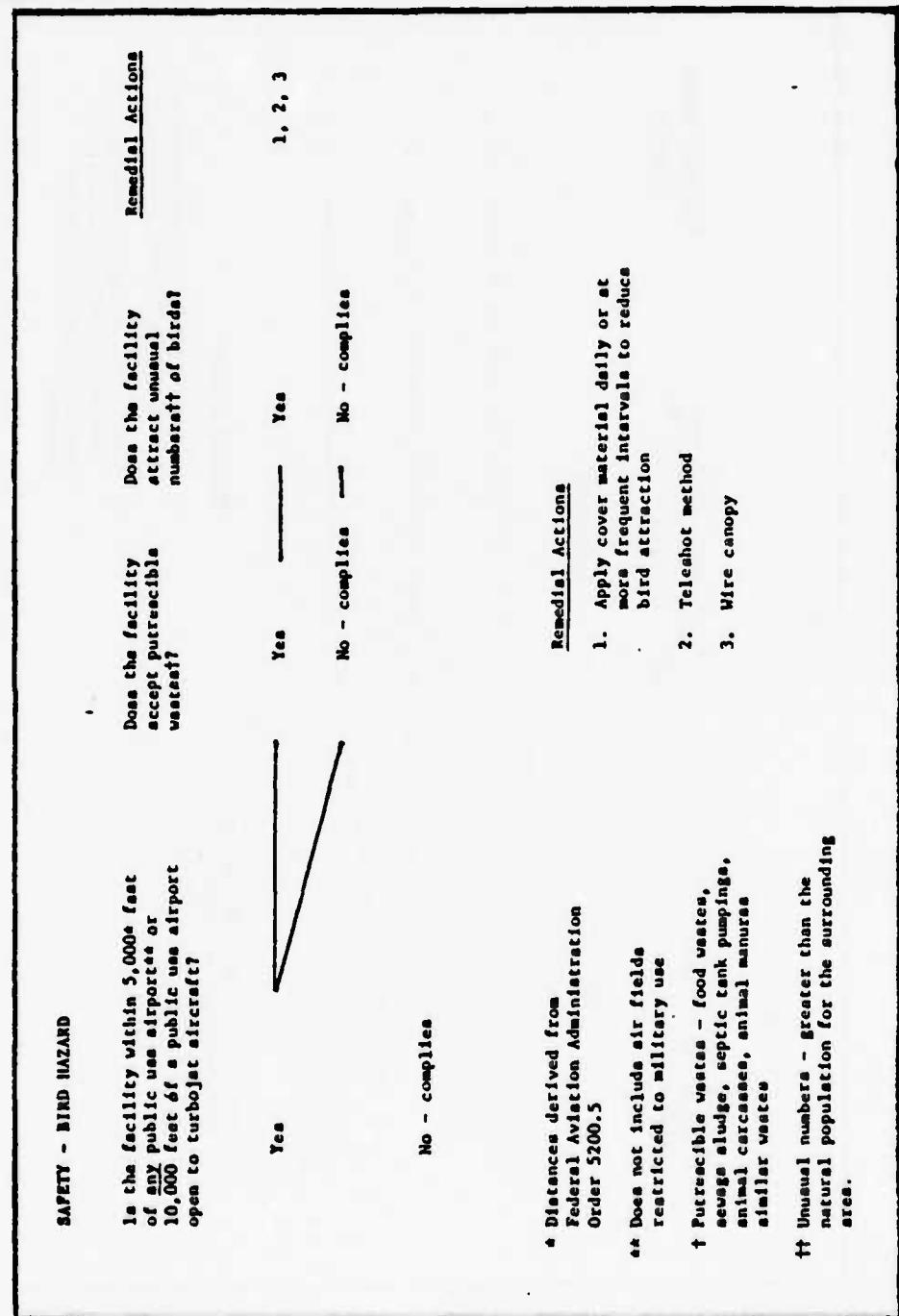


Figure 3-11 Safety - Bird Hazard

SAFETY - ACCESS	
Is access to the site limited to authorized personnel during operating hours?	
Is the site gated and fenced, or regularly patrolled during nonoperating hours?	
<u>Remedial Actions</u> <u>Required</u>	
Yes - Complies	
Yes	No
1	
Yes	
2	
No	
1, 2	
<u>Remedial Actions</u>	
4. Regular Patrol - security guard is on site during all non-operational hours and periodically patrols the fill area.	
1. Control access by fence and gate, or regular patrol when not operating	
2. Limit access during operation to authorized personnel by proper gate keeping and patrolling by site personnel.	

Figure 3-12 Safety - Access

4.0 REQUIREMENTS FOR CONSTRUCTION OF NEW SOLID WASTE DISPOSAL SITES

The purpose of this chapter is to assess the requirements the Navy must implement in constructing new solid waste disposal facilities which comply with the Federal criteria. This study assesses both the legal and economic considerations as well as the technical considerations which pertain to new site construction. Many Naval facilities are located in areas that are typified by wetland topography. Due to many logistical and economic constraints, the Navy has been forced in the past to construct landfills in wetlands. Current Federal regulations strongly discourage the construction of landfills in wetlands, and as a consequence many criteria must be met prior to obtaining permission to construct a wetland landfill. Thus, this chapter has two segments - that for siting new facilities in wetlands and that for siting new sites at other locations.

The first segment will deal with requirements for general site development including:

- o Institutional requirements - appropriate permitting for the site from state and Federal agencies;
- o Information requirements - information needed to assure site compliance with the RCRA Section 4004 criteria, and to complete any environmental assessments or NPDES and 404 Dredge and Fill permits necessary; and
- o Technical requirements - requirements that the site must meet to satisfy the RCRA 4004 criteria.

The second segment will deal with any additional requirements necessary in developing solid waste disposal facilities in wetlands, specifically dealing with current regulations of facility development in wetland areas and the 404 Dredge and Fill permitting process.

4.1 GENERAL SITE DEVELOPMENT

In planning the development of new solid waste disposal facilities, care must be taken to insure that the facility will comply with the RCRA 4004 criteria. Through careful evaluation of information either available from existing sources or developed during the planning stage,

this compliance can be obtained with minimal costs. For example, if it is known that the facility will be used for disposing of prescible wastes, sites within two miles of public use runways should be ranked low as potential sites. Because of possible hazards from birds.

Some of the information and technical requirements are of a general nature and may be useful in evaluating a site for several or all criteria. These are addressed in Section 4.1.1, General Requirements. Others specifically relate to a criterion and are ordered accordingly.

4.1.1 General Requirements

Institutional

The facility will require permitting by the appropriate state agency. In general, this permitting may be expedited by inclusion of the state agency in the planning stages of site development so that all state requirements may be met. While state permitting requirements must at a minimum set the same standards as the Criteria, individual states may have stricter or additional standards for new sites.

Informational

General information necessary includes the following:

- the type, source quantity, composition, method of transportation and disposal, of the material for disposal;
- the location, dimensions, and type of all nearby structures, names and addresses of adjacent property owners, and general character of the area;
- future development plans for the area in which the facility will be located; and
- the type of area the site will be in, e.g., floodplain, wetland, ripland, karst terrain, etc.

This information may be acquired through:

- a waste composition study to determine quantity and type of waste; and
- the use of facility plans, maps, and development plans.

Technical Requirements

Most site technical requirements directly apply to a specific criterion. However, in general, a site should not be in a:

- floodplain;
- wetland;
- zone of active faults; nor

Although development in these areas is not specifically prohibited, they are environmentally sensitive areas where complying with one or more of criteria may prove technically difficult.

4.1.2 Floodplains

Institutional

The siting of solid waste disposal facilities in floodplains is discouraged by EPA. In order to build such a facility, an Environmental Assessment would have to be completed, and, depending on specific development plans, a Dredge and Fill permit and NPDES permit would have to be obtained.

Informational

In developing a facility in a floodplain, the information needed includes that necessary to receive a 404 and possibly a NPDES permit. This information will be available from that generated in section 3.1.1. Additionally, the height of the 100 year base flood must be known to construct appropriate levees.

Technical

If the site is allowed to be developed in a floodplain, the requirements it will have to meet are identical to those for existing sites.

4.1.3 Endangered Species

Informational

The information required for this criterion is:

- whether or not there is an endangered species on site or if the site is in a critical habitat;
- if an endangered species is present, its identity, where it is in the site, and whether the facility will impact it;
- if the facility is in a critical habitat area whether the species whose critical habitat it is is likely to utilize that specific site. For example, if the species is a cave dwelling bat, the facility would not be likely to effect it unless there were caves immediately near the facility. Otherwise, while the facility was in a critical habitat area, it is not likely to be impacting the animal.

This information can be developed using information from the Department of the Interior and through a complete biological evaluation of the site.

Technical

If the site is found to be in a critical habitat or if an endangered species is on site, it is unlikely that development would be permissible. If it were allowed, the site would have to be designed in such a way so as to preserve the endangered species or critical habitat.

4.1.4 Surface Water

Institutional

If the facility will cause a discharge to a surface body of water, a NPDES permit will have to be obtained from the appropriate state agency. For example, discharges of collected surface runoff or treated leachate would require a NPDES permit.

Informational

The preliminary information required is the proximity of the site to the nearest body of water and whether the site will discharge to that body. If it will, a NPDES permit will be necessary. This will require:

- the latitude and longitude of the discharges, and the name of the receiving water;
- a line drawing and water balance showing origin of the discharge;
- an identification of each contribution to the total flow and the amount contributed;
- information on effluent characteristics such as BOD, COD, TOC, TSS, ammonia, temperature, and pH. Additionally, information on quantity of other pollutants, if the applicant suspects their presence, should be supplied.

Technical

The discharge from such a facility will have to have a minimum surface impact on the receiving body of water. At the development state, the only discharge expected would be of collected surface runoff, which would have to be settled to remove sediment prior to discharge.

4.1.5 Groundwater

Information

Information required for new site development includes the following:

- quantitative information on the groundwater quality of the underlying aquifer, including information on;
 - TDS
 - Amounts of pollutants identified in the National Interim Primary Driving Water Standards

- depth to mean seasonal high water table;
- the direction and rate of underlying groundwater flow;
- general information on site geology including;
 - distance to and type of bedrock
 - hydraulic conductivity
 - attenuation characteristics of underlying soils, soil permeability
 - type of geology, e.g., is it a karst terrain
- a water balance for the site, to determine probable leachate generation amounts. This requires information on;
 - annual precipitation
 - amount of surface runoff onto site
 - amount of surface runoff off site
 - annual evapotranspiration
 - groundwater information previously described

This information may be obtained through the use of test wells, soil borings, and soil tests.

Technical

The site must not result in any negative impacts on groundwater quality. To assure this:

- the bottom of the site should not be dug deeper than 1.5 meters above the mean seasonal high water table;
- the site should be protected from surface water runoff and streams through the site should be diverted around it;
- the site should be lined with either a natural or artificial liner unless the underlying soils or rock are of low permeability, or the water balance indicates that no leachate will be generated;

- a leachate control system should be installed in areas where the water balance indicates that the site will generate leachate or at any site which has a liner;
- groundwater monitoring wells should be installed outside the planned soil waste perimeter, including both up gradient and down gradient wells, and analyzed frequently.

4.1.6 Disease

No additional requirements, beyond those for existing sites, are required for new sites.

4.1.7 Air

No additional requirements, beyond those for existing sites, are required for new sites.

4.1.8 Safety-Explosive Gases

Technical

Additional technical requirements for new sites includes:

- that the site is not traversed by pipes or conduits, or other underground dikes, which may act to ease gas migration off-site; and
- that a gas control system should be installed if the fill is to accept putrescible wastes.

4.1.9 Safety-Fires

No additional requirements, beyond those for existing sites, are required for new sites.

4.1.10 Safety-Bird Hazard

Technical

The facility should not be located within two (2) miles of a public use runway. If it is, estimates of native bird populations should be made prior to construction for comparisons once the facility is operational. If the facility attracts a greater number of birds than the previous population, it violates this criterion and remedial action will be needed.

4.1.11 Safety-Access

No additional requirements, beyond those for existing sites, are required for new sites.

4.2 WETLAND SITES

The placement of solid waste disposal facilities in wetlands is a long-standing practice which has become increasingly discouraged in recent years as scientific understanding of the value of wetlands has increased. Originally looked upon as areas with little intrinsic value, suitable only for filling-in to create "useful" land, it is now realized that wetlands are one of the most productive of all ecosystems. The destruction of wetlands adversely impacts the ecological balance of environments ranging from the marine to the upland. EPA briefly outlined the importance of wetlands in the Statement of Policy on Protection of Nation's Wetlands (38 FR 10834, March 20, 1973), where it is stated that:

"The nation's wetlands are unique, valuable, irreplaceable water resources. They serve as a habitat for important furbearing mammals, many species of fish, and waterfowl. Such areas moderate extremes in water-flow, aid in the natural purification of water, and maintain and recharge the ground water resource. They are the nursery areas for a great number of wildlife and aquatic species and serve at times as the source of valuable harvestable timber. They are unique recreational areas, high in aesthetic value, that contain delicate and irreplaceable specimens of fauna and flora and support fishing, as well as wild-fowl and other hunting."

Recognizing the ecological importance of wetlands, and the damage and destruction already done to thousands of irreplaceable acres of wetlands due to human activity, EPA has taken a strong stand against further construction in these areas. The policy and regulatory statements outlining this stance are discussed below.

EPA Statement of Policy on Protection of Nation's Wetlands (38 FR 10834, March 20, 1973)

This document states EPA's early position on wetlands. Wetlands are defined as marshes, swamps, bogs, and other low lying areas which are, during some part of the year, covered by non-flood waters. The aims of the policy put forth in this statement are to:

- Minimize alterations in the flow of water into a wetland; and
- Protect wetlands from adverse solid waste management, dredge and fill, and other construction practices.

Implementation of this policy includes controlling pollution from existing Federal institutions or facilities and discouraging the use of Federal funds for further construction in wetlands.

Executive Order 11990 Protection of Wetlands (May 24, 1977)

This Executive Order strengthens the Federal position against continued development of wetland areas. It directly charges Federal agencies, including the military departments, to provide leadership and take action to:

"...minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities."

Federal agencies may undertake new construction in wetlands only if there are no practicable alternatives to such construction. In such a case, all practical steps must be taken to mitigate the damaging effects of such construction on the wetland environment. Therefore, in making economic comparisons of alternative facility locations, costs for mitigating activities necessary for wetland construction should be included in cost estimates for those sites situated in wetlands. Additionally, the environmental impacts of construction at the possible locations should be assessed. Construction in a wetland site should only be approved if the economic and environmental assessments indicate that construction at all other sites is prohibitive expensive and/or would have more serious environmental consequences than construction in the wetland site. The Department of Defense implemented this Executive Order in its Construction Criteria (DOD 4270.1-M, July 1, 1978), requiring DOD projects to minimize their impact on wetlands and avoid further construction in these areas whenever possible.

In this order the definition of wetlands is extended to include areas such as wet meadows, where vegetation requiring saturated or seasonally saturated soils are prevalent. Inundation of the area by water is not necessary for inclusion as a wetland under this definition, which is largely based on the biological characteristics of the site. Areas which are classified as wetlands under this definition, which is currently accepted for regulatory purpose; includes but are not limited to:

- swamps;
- marshes;
- bogs;
- sloughs;
- potholes;
- wet meadows;
- river overflows;
- mud flows; and
- natural ponds.

Guidance for Standards

This document puts forth the Navy's response to Executive Order 11990. It states that:

- The Navy will integrate floodplain management and wetlands protection requirements into its existing management, consultation, planning, decision making, and public participation programs. Naval installations will insure that their forestry, outdoor recreation, natural area, fish and wildlife, historic preservation, archaeological, and land management programs are compatible with minimization of flood hazard and restoration and preservation of wetlands and floodplains;
- For action located in floodplains and wetlands an environmental document (assessment or statement) will be required to comply with the National Environmental Policy Act of 1969. Actions located adjacent to floodplains and wetlands will require an environmental assessment;

- Appropriate action will be taken to avoid direct or indirect support of new construction in wetlands whenever there are practicable alternatives;
- Opportunities will be provided for early public review of all plans or proposals for actions in wetlands or floodplain areas even if the impact is not significant enough to require an environmental impact statement. Notice of intent to conduct, support or allow actions in floodplains or wetlands will be prepared and circulated. Forthright solicitation of suggestions and comments from the public is required;
- Requests for new authorization or appropriations for proposals in or potentially affecting floodplains or wetlands must be justified by a statement that the proposals comply with intent of the executive orders;
- In lease, easement, right of way or disposal transactions the Navy will reference existing Federal, state, or local wetland regulations, attach other appropriate restrictions, or withhold such property from disposal.

Landfill Disposal of Solid Waste - Proposed Guidelines
(40 CFR Part 241, March 26, 1979)

These proposed guidelines suggest preferred methods for the design and operation of sanitary landfills accepting solid, but not hazardous, wastes. Including in the guidelines are recommended practices concerning site selection and environmentally sensitive areas, including wetlands. They recommend that these environmentally sensitive areas be avoided or receive lowest priority as potential locations for sanitary landfills. However, if they are further considered two areas should be addressed:

- Alternatives - alternative disposal techniques and locations should be evaluated along hydrogeological, technical, environmental, and economic criteria. Increased cost should not eliminate an alternative in favor of using an environmentally sensitive area
- Impact - a comprehensive analysis of the effect of the facility on the environmentally sensitive area should be performed and submitted to the proper agency. This analysis should include an estimate of the facilities environmental impact on the area, and plans for mitigating this impact.

Additionally, the guidelines recommend that the ground water level be at least 1.5 meters below the bottom of the landfill at its seasonal high. To accomplish this, it may be necessary to lower the water table in a wetland area.

Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR Part 257, September 21, 1979)

Although not specifically mentioned in the criteria, wetlands are considered to be waters of the United States, and, therefore, any discharge of solid waste into such waters would require a 404 Dredge and Fill permit, issued by the Army Corps of Engineers. Although EPA's original stance on this topic was that disposal in wetlands should be governed under the NPDES program unless the primary purpose of such disposal was that of filling rather than disposal, they revised their position in the newly promulgated Consolidated Permit Regulations (Federal Register, May 19, 1980, 33290-33588) and placed all such disposal, regardless of primary purpose, under the 404 permit program. This was done for several reasons:

- The disposal or deposit of either fill material or solid waste in a wetland leads to the equivalent result, the loss of waters of the United States, regardless of whether the primary purpose of the operation was filling or disposal.
- The primary purpose test is difficult to apply.
- The 404 regulations are better suited to the protection of wetlands and the types of operations involved in solid waste disposal.

The regulations on the permit would state specifically what criteria the facility would have to meet to be allowed to operate. In general, however, it is expected that the facility would, through its design and operation, have to minimize its impact on the quality and extent of the wetland area.

EPA Interim Regulations on the Discharge of Dredged or Fill Material into Navigable Waters (40 CFR Part 230, September 5, 1975)

These regulations were promulgated by EPA to provide the criteria by which the Corps of Engineers evaluated 404 permits

applications. Their requirements with regard to permitting any discharge of fill material in wetlands are quite specific. They require that:

- the activity associated with the fill must be in proximity to or in the water to fulfill its basic purposes, or that other site alternatives are not practicable; and
- the proposed fill and activity associated with it will not cause permanent unacceptable disruption to the beneficial users of the affected aquatic systems.

In interpreting these requirements, the Corps of Engineers has arrived at four criteria for determining site permissibility. These four concern:

- the relative extent of public/private need for the facility;
- the relative economic and environmental desirability of alternatives;
- the extent of detrimental and/or beneficial effects of the proposed facility; and
- the probable impact of the specific facility in relation to the cumulative effects of past and proposed projects in the area on area wetlands.

Discussion with officials in the Baltimore District Engineer's Office Permits Division indicated that the siting of solid waste disposal sites in wetlands is strongly discouraged and permits are not issued unless it is shown that there are essentially no alternatives to the proposed site. To do this it must be shown that the economic costs for developing alternative sites are several times higher than those for the wetlands site, and/or that the environmental costs for developing alternative sites are equivalent to or greater than the cost of the loss of the wetland.

4.2.1 General Requirements

The major general requirements to be met by the Navy for siting solid waste disposal facilities in wetlands are to file applications for and receive 404 Dredge and Fill permits and State certification for each proposed facility. Additionally, if the

operation at the proposed facility will cause a point-source discharge to the waters of the United States (such as a discharge from ground water depression wells), a NPDES permit will be necessary for that discharge.

Dredge and Fill Permits

Dredge and Fill Permits are issued by the District Engineer's Office of the Army Corps of Engineers. The guidelines for permit approval were developed by EPA, which may be involved in permit approval through the Regional Administrator's Office. Applications for a 404 permit should include the following:

- a complete description of the activity, including plans and drawings;
- the location, purpose, and planned use of the activity, including the name of the body of water affected and a schedule of activity;
- the locations and dimensions of adjacent structures and names and addresses of adjacent property owners, if any;
- all approvals necessary from other Federal, Interstate, State, or local agencies;
- a description of the source, type, quantity, composition, and method of transportation and disposal, of the fill material;
- State certification under Section 401 of the Clean Water Act (CWA) that the discharge will comply with Section's 301, 302, 303, 306, and 307 of the CWA (will not violate applicable state water quality standards);
- Any additional information required by the District Engineer. In the case of wetlands disposal, this information may include:
 - descriptions of alternatives considered, including site locations, development costs, environmental types, biological and geological characteristics, and brief estimates of expected environmental impacts;
 - a biological evaluation of the wetlands for endangered species or critical habitats of an endangered species.

To achieve the State certification required for approval of a 404 permit application, the Navy will have to provide the state agency responsible for implementing the CWA with a copy of the completed application. The state will determine if the proposed project will violate applicable state water quality standards and will either provide state certification, provide certification with certain requirements or deny certification. Without certification the Corps cannot issue a 404 permit.

When a completed application with state certification is received by the District Engineer, copies of section of the application dealing with water quality are forwarded to the EPA Regional Administrator, who will determine if other states are effected and notify any so effected. The District Engineer's Office is responsible for preparing an Environmental Assessment of the facility using information in the application and additional information generated by Corps personnel, and for issuing a Public notice on the facility containing the information provided by the applicant. If, following completion of the Environmental Assessment that the facility requires an Environmental Impact Statement, the District Engineer's Office will prepare that document.

Based upon the results of the Environmental Assessment and, possibly, the Environmental Impact Statement, the District Engineer will either issue or deny the permit. Additionally, should the Regional Administrator identify other states which may be effected, those states may object to the issuing of the permit and, if the objections are upheld, the permit will be denied.

NPDES Permits

The development and operation of a solid waste disposal site in a wetland is likely to require the use of technologies which will result in a point-source discharge to the waters of the United States. The use of a well-point pumping system to depress the water table below the bottom of the landfill, and the use of ditches and conduits to divert surface waters around the fill boundaries, are two examples of typical operations which would require a NPDES permit. Applications for such a permit would be made to the appropriate EPA Regional Administrator or the Director of the State agency responsible for enforcing the CWA in states with an approved implementation plan. These discharges would be considered new discharges and the application will probably require the following:

- the latitude and longitude of the discharges, and the name of the receiving water;

- a line drawing and water balance showing the origin of the discharge;
- an identification of each contribution to the total flow and the amount contributed; and
- information on effluent characteristics such as BOD, COD, TOC, TSS, ammonia, temperature, and pH. Additionally, information on quantity of other pollutants, if the applicant suspects their presence, should be supplied.

The Navy will have to receive a permit from the proper state or federal official prior to initiating discharges resulting from the development or operation of each proposed landfill.

Additional General Requirements

Other general requirements are specific for sites in wetland environments. These include the following:

- information on the alternative site considered, including the wetland site, including the following:
 - estimates of site development costs
 - preliminary assessment of the environmental impacts of the various alternatives, including estimates of the biological productivity of the sites, number of species to be displaced by the project, groundwater and surface water impacts, and future plans for site;
 - site locations and site sizes (including expected depth of site as well as surface area);
- the surface area of the site should be minimized to minimize its impact on the wetland, which may require deeper excavation and/or building to a higher grade, depending on the bearing strength of the substrata. Additionally, bale filling may lower size requirements;
- the fill should be isolated from surrounding surface bodies of water, including the surrounding wetlands. Streams and surface runoff running onto and/or through the site should be diverted around it, and any springs located on site should be isolated from any contact with solid waste; and

- the water table should be maintained at least 1.5 meters below bottom of fill.

In addition to these requirements, some states may demand more stringent controls. For example, the Commonwealth of Pennsylvania requires new landfills to have a liner regardless of the characteristics of underlying soils. Facility engineers should find out from the appropriate state agency if any more stringent requirements need to be met in their state.

4.2.2 Criteria Requirements

In addition to those specific requirements for wetland sites discussed in Section 4.2.1, sites located in wetlands will have to comply with all the requirements outlined in Sections 4.1.1-4.1.31 in order to comply with current Federal regulations.

5.0 SUMMARY

5.1 Active Disposal Sites

Section 4004 of RCRA "Criteria for Classification of Solid Waste Disposal Facilities and Practices," was developed to provide minimum standards for determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on human health or the environment. The Navy, like any other Federal agency, must comply with the Criteria and any State regulations pertaining to the disposal of solid waste.

5.2 Siting of New Solid Waste Disposal Facilities

In siting new solid waste disposal facilities, the Navy should consider future plans for the site and the area around it, the impact of the facility on the area, and the ability of the site to satisfy the RCRA 4004 criteria in an economical manner. The best use should be made of areas with attenuating, low permeability soils, deep water tables, and low volumes of surface runoff. In areas with these characteristics, development costs are low and proper site operation relatively simple. The Navy should avoid areas such as wetlands, 100-year floodplains, and karst terrains, where development costs and probability of significant adverse environmental impacts are high.

However, if the Navy decides to site solid waste disposal facilities in wetlands, it may be possible to do so, but only if no other practicable site exists. The Federal Government has given high priority to protecting wetland from future development, including use as sites for solid waste disposal facilities. The primary means available at the Federal level for regulating the development of solid waste disposal facilities in wetlands is the requirement that they receive a 404 Dredge and Fill permit and that they comply with the RCRA 4004 criteria. In order to receive a 404 permit, the Navy must show that:

- o alternative sites have been considered and that no other alternative is practicable;
- o the project will be carried out in such a way as to minimize its impact on the wetland; and
- o the project will not adversely impact an endangered species.

Should the site receive a permit, it must be developed in such a way as to comply with the RCRA 4004 criteria. This generally means that development should follow the EPA proposed guidelines for Landfill Disposal of Solid Waste. The basic aims of these requirements are to:

- o insure safe operation of the site;
- o isolate the site from nearby surface water;
- o isolate the site from the groundwater underlying the site; and
- o otherwise minimize the impact of the facility on the surrounding human and physical environments.

The siting of solid waste disposal facilities in wetlands adds both to the number and the technical difficulty of the requirements with which a new site must comply. Additionally, it adds to the massive cumulative destruction of wetlands which has been carried out in the past out of ignorance of the valuable ecological role of these areas. For these reasons, such activities should be carried out in the future only if all alternatives are exhausted.

DATE
TIME